Precise temperature
and humidity control
for any application

2020 PCU Range

AIR CHANGE
DOAS & DEHUMIDIFICATION

Introduction

Humidity, whether generated by the introduction of outside air, infiltration, or building use can impact the building function and lead to unpleasant and toxic mould formation if not correctly controlled.

Air conditioning is not the answer; it is temperature controlled and cycles off or reduces capacity when the room temperature reaches set point, reducing its moisture control capability during this off-cycle period.

The alternative: set the temperature low enough to continuously run the cooling cycle and maintain humidity control, but unless the room has a high sensible load factor, the space will soon become cold and uncomfortable for the occupants and use much more energy than necessary.

When this occurs, a reheat source is required to raise the room air temperature to an acceptable level, having regard for the room sensible load. Electric elements and hot water coils are commonly used as the air reheat source, requiring additional energy input.

The alternative to dehumidification by air cooling is to use a desiccant dehumidifier, but the regeneration air requirement can be costly and needs additional regeneration air ductwork. Consider the two psychrometric charts of figure 1 and 2; the first depicting a cool and reheat system, and the second showing a desiccant dehumidifier achieving the same outcome.

In both cases, the air must be processed from a hot moist condition at point 1 on the chart to a supply condition that is both cooler and less humid, represented by point 4.

In the first case, air will first be cooled to reach the saturation line along path 1–2, further cooled along path 2–3 until it reaches its desired dew point temperature, then heated along path 3–4 to reach its desired set point temperature.

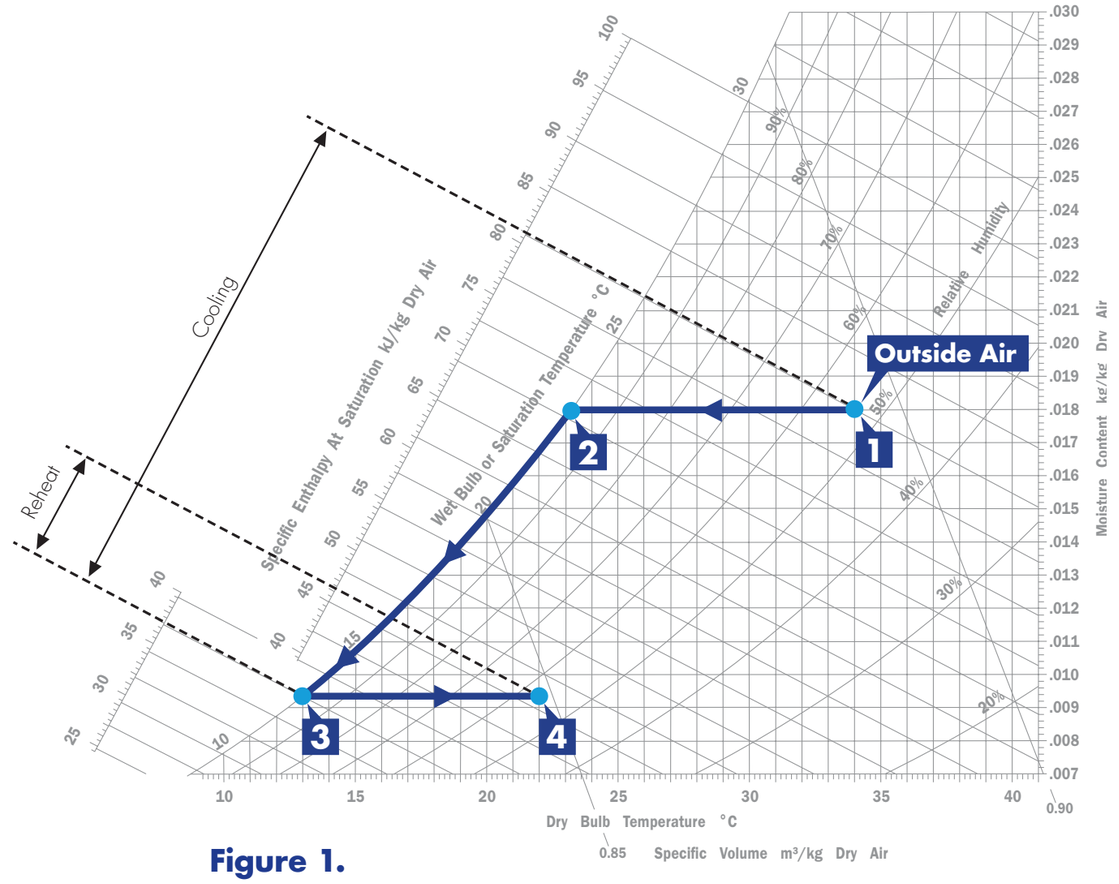


Figure 1.

The second chart depicts a simple desiccant system in which the air must be transformed from a condition at point 1 to a temperature and humidity represented by point 3, but the path is very different.

The air first passes through a desiccant wheel where the desiccant removes moisture to the desired level, simultaneously heating the air to a condition at point 2. The air must now be cooled to reach its desired set point temperature at point 3. To remove the moisture absorbed by the desiccant, a hot air regeneration source is required. Outside air or exhaust air must be heated to a temperature represented by point 4 on the psychrometric chart before passing this hot air stream back through the enthalpy wheel to remove the absorbed moisture. This regeneration air increases in humidity and decreases in temperature along path 4–5. While there are many different configurations of desiccant dehumidifiers, this basic principle always applies. Heating the regeneration air consumes significant energy to ensure the desiccant performs its moisture absorption function.

Air Change provides specialised PCU dehumidification solutions for dedicated outdoor air systems (DOAS), full recirculation systems, or mixed airflow systems based on the air cool and reheat principle.

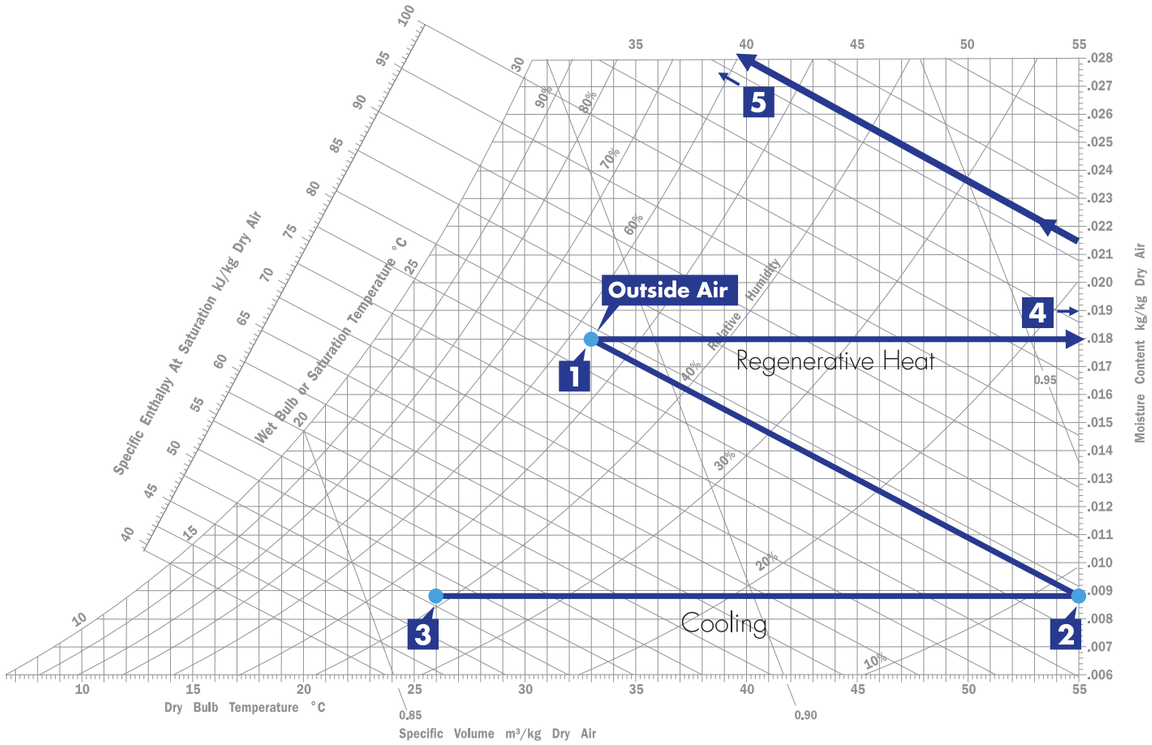


Figure 2.

The Air Change PCU range of dehumidification systems – precise temperature and humidity control for any application.

Air Change PCU Products

As with all Air Change products, the objective of the PCU range of dehumidifiers is to deliver air at the specified temperature and humidity using the lowest possible energy consumption.

We have chosen to use the cool and reheat principle rather than desiccant dehumidification because in most – but not all – circumstances, this is the more energy efficient and convenient method of delivering air humidity and temperature control where part of the cool and reheat work is done with efficient air to air heat exchange. Eliminating the need for high temperature regeneration air lowers the energy consumption in many conditions and eliminates regeneration air ductwork giving more flexibility to the system designer.

The Air Change range of PCUs are grouped into three distinct categories:

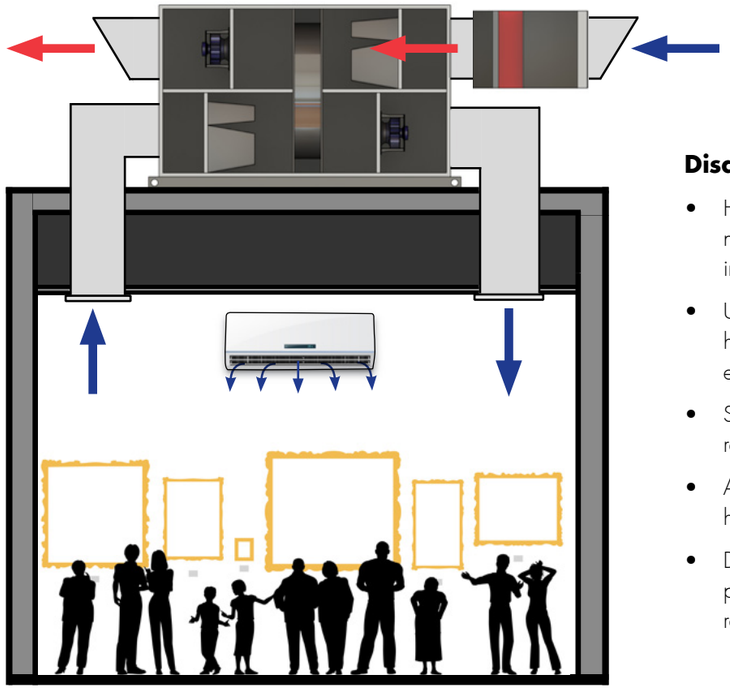
- the **PCU-N** where there is no spill air and plant room space prohibits the PCU-S solution;
- the **PCU-E** for applications that have spill air available to minimise refrigeration energy by precooling and dehumidifying the air in an enthalpy heat exchanger; and
- the **PCU-S** for applications with no spill air but can accommodate heat exchangers to precool and reheat the air to reduce refrigeration cooling capacity.

To minimise energy consumption in our PCUs, we couple our internationally patented heat exchanger, where possible, with the latest developments in variable speed and inverter drives, compressor and refrigerant control technologies and EC fans.

When available, we can use chilled water as the sole or partial cooling source to minimise the refrigeration capacity of the PCU – a system we call hybrid cooling.

Additionally, we have developed complex control algorithms with our ClimaSync Control System to deliver precise control of air temperature and humidity at the lowest whole of life cost.

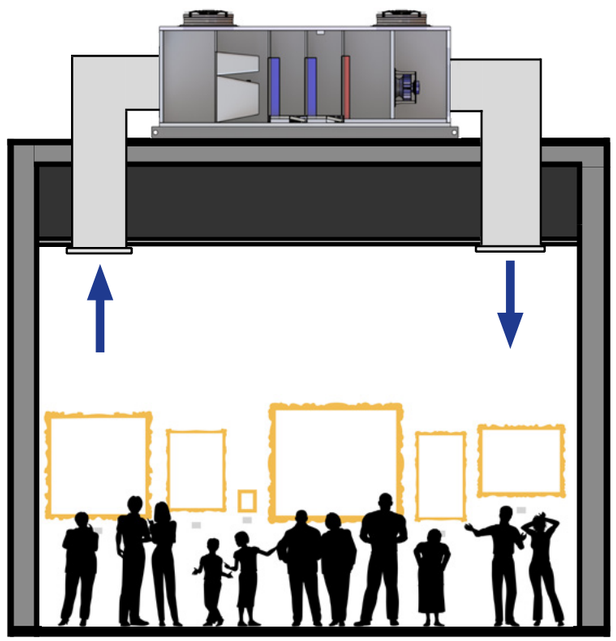
The Desiccant Dehumidification Approach



Disadvantages

- Hot regeneration air is required which needs a separate heat source and increases installation complexity;
- Unless waste heat can be sourced, the hot regeneration air adds to the overall energy consumption of the system;
- Separate cooling equipment is generally required for the sensible load;
- AHU size needs to be large in order to house the desiccant wheel;
- Desiccants can degrade and under-perform, particularly when insufficient regeneration heat has been supplied.

The Air Change PCU Approach



Advantages

- No hot regeneration air and associated ductwork required;
- By using waste condenser heat for the reheat function instead of separate HHW coils or electric duct heaters, overall energy consumption is reduced;
- The sensible and latent cooling loads are addressed by the one piece of equipment;
- Unit size is small without the need to house a desiccant wheel;
- The integrated ClimaSync Control System simplifies unit commissioning and ensures ongoing performance;
- Optional air-to-air heat exchangers can provide significant energy savings in applications requiring large amounts of outside air.

Projects

Pharmaceutical

- CSL Hazardous Goods Store
- Alphapharm Carole Park
- Oxford Compounding
- Australian Natural Therapeutics Group
- Slade Health Geebung

Scientific Labs

- University of Queensland Frank White Building
- Trade Coast Soil Test Lab
- QUT Central Analytical Research Facility
- ARC Centre of Excellence
- Ellume Health

Museums & Archive Storage

- Australian Museum Long Gallery
- Shoalhaven Arts Gallery
- Redland Art Gallery
- Murrook Cultural Centre
- Port Pirie Museum
- UNSW Library R1 Facility

Manufacturing Process & Industry

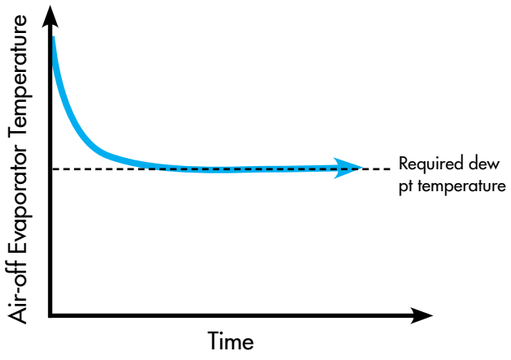
- Ayr Prawn Processing Facility
- TAE Turbine Engine Maintenance Facility
- CDC Surfside Data Centre
- Lion Dairy
- Almondco Australia

Hospitals

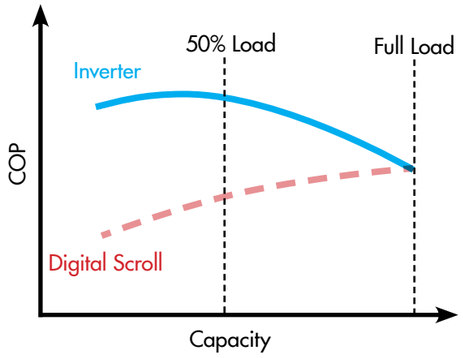
- Maroochydore Day Hospital
- Queen Elizabeth II Hospital
- Ballina Hospital
- Hillcrest Private Hospital
- Chermside Day Hospital

BLDC Inverter Compressors

The variable capacity control of inverter compressors allow units to precisely meet the required dew point temperature without compressor on/off cycling and hence maintain constant dehumidification. Inverter compressors also offer much higher energy efficiency than fixed speed compressors with hot gas bypass or digital scroll compressors.



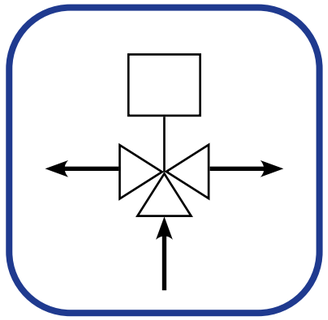
Smooth and steady control of evaporator air temperature achieved by inverter compressors.

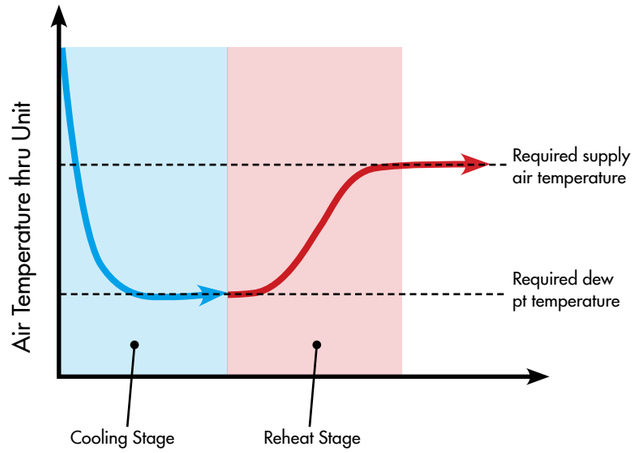


Indicative COP vs. capacity profiles of inverter and digital scroll compressors.

EC Supply Air and Condenser Air Fans

EC fans offer optimal levels of energy efficiency. The EC plug fans used for supply air are able to handle high static pressures, making them suitable for applications requiring high filtration grades or long ductwork runs. The EC axial condenser air fans are automatically speed controlled to maintain stable refrigeration pressures.





Precise 3-Way Reheat Valves

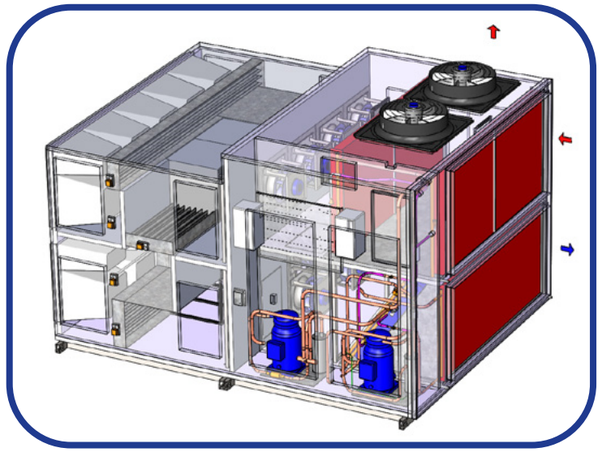
Once the air has been cooled to the required dew point temperature, it then passes through a coil to be reheated to the required supply air temperature. By using precisely modulating 3-way refrigeration valves instead of pulsed solenoid valves to divert hot gas to the reheat coil, far greater stability and reliability is achieved.

ClimaSync **Control System**

The ClimaSync Control System which is included with each Precise Control Unit ensures optimal performance and reliability. The control logic and operational functions are programmed to meet the requirements of each project. Features include proactive thermostat logic, performance status and trends, advanced protection logic, alarm histories, and time scheduling. Unit operation is achieved through touchscreen human machine interface, high level interface, or through online connectivity.

Bespoke Design

Air Change Precise Control Units are highly flexible in design and can be engineered around project specific requirements. Split or packaged configurations of each model are available.

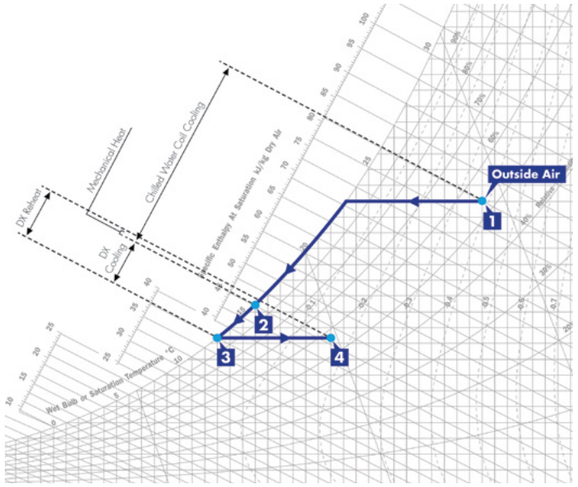


PCU-N

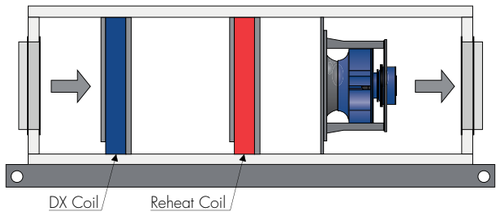
For when plant room space or configuration and unit capacity precludes the use of the PCU-E and PCU-S.

Although not as energy efficient as the PCU-E or PCU-S, it is more efficient than a typical cool and reheat system using electric element heaters or hot water coils because sufficient heat is removed by the DX evaporator to perform the reheat function.

Like both the PCU-E and PCU-S, the PCU-N is usually configured in a DOAS application but can be used where there is a mixed recirculation system with a high percentage of ventilation air and can be ordered as a full DX system, a hybrid or for low dewpoint applications.

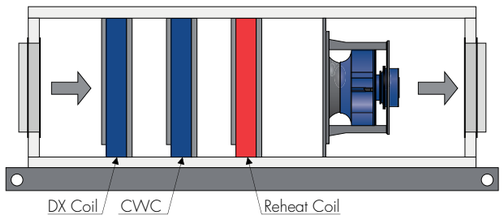


PCU-N-D DX Cooling



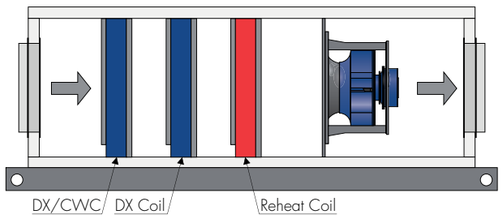
The PCU-N-D uses a DX evaporator to cool the air to its specified dewpoint, then uses a precise three-way modulating valve to direct sufficient condenser heat to a reheat condenser coil to raise the air to its set point temperature with the remainder directed to an external condenser

PCU-N-H Hybrid Cooling



The PCU-N-H uses a DX evaporator to take only enough heat from the air that is needed for reheat. The air is then cooled to its specified dew point with a CHW coil before being reheated with the reheat condenser coil. As the DX evaporator only takes the heat it needs for reheat, there is no waste heat generated and therefore no outside condenser required.

PCU-N-LD Low Dew Point



The PCU-N-LD uses two cooling coils, the first being either a CHW coil or a DX evaporator, the second is a DX evaporator to lower the air to its specified dewpoint. A precise three-way modulating valve directs sufficient condenser heat to reheat the air to its set point temperature with the remainder either directed to an external condenser or removed through the chilled water circuit.

Technical Data

PCU-N-D							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		0 - 100%					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	Reverse cycle available upon request					
Supply Air Moisture Content		>8g/kg dry air					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Packaged Configuration Dimensions#							
Approx. Overall Width (mm)		1750	1900	1900	2150	2300	2300
Approx. Overall Depth (mm)		3100	3100	3800	3800	3700	3950
Approx. Overall Height (mm)		1450	1750	2200	2250	2100	2100
Approx. Weight (kg)		650	900	1250	1450	1850	2000

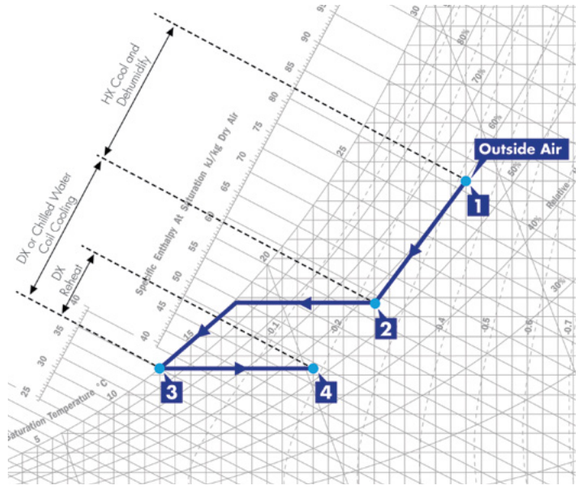
PCU-N-H							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		0 - 100%					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	N/A					
Supply Air Moisture Content		CHW temperature dependent					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Packaged Configuration Dimensions#							
Approx. Overall Width (mm)		1200	1400	1550	1850	1950	2100
Approx. Overall Depth (mm)		2200	2200	2350	2350	2450	2300
Approx. Overall Height (mm)		1200	1400	1500	1500	1750	1800
Approx. Weight (kg)		400	550	650	750	1000	1050

PCU-N-LD							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		0 - 100%					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	Reverse cycle available upon request					
Supply Air Moisture Content		>5g/kg dry air					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Packaged Configuration Dimensions#							
Approx. Overall Width (mm)		1650	1900	1900	2000	2300	2300
Approx. Overall Depth (mm)		3650	3650	4100	4300	4100	4400
Approx. Overall Height (mm)		1400	1600	2000	2200	2250	2250
Approx. Weight (kg)		900	1150	1400	1600	2250	2350

*Specifications are subject to change. Refer to project certified documents for finalised details.
#Split configurations are also available.

PCU-E

The original and most energy efficient Air Change dehumidification system for applications that have spill air.



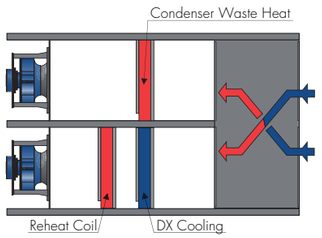
The PCU-E is fitted with an efficient enthalpy heat exchanger to pre-cool and dehumidify the outside air using the cooler dry exhaust air. This enthalpy exchange process reduces the refrigeration energy required to cool the air to its specified dew point temperature.

This dehumidification unit is usually configured in a DOAS application but can be used where there is a mixed recirculation system with a high percentage of ventilation air.

The PCU-E can be ordered in three different configurations:

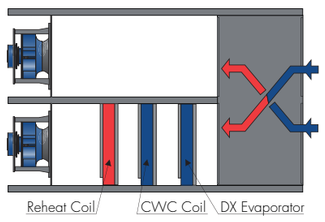
1. a **full DX** cooling system for applications with no chilled water source;
2. a **hybrid** version (part DX and part chilled water cooling) when chilled water is available and DX cooling is only required to supply reheat, particularly useful when the plant room location makes DX external condensing difficult; and
3. a **low dew point** version for low moisture content applications. The LD system is supplied as either a DX or hybrid cooling system.

PCU-E-D DX Cooling



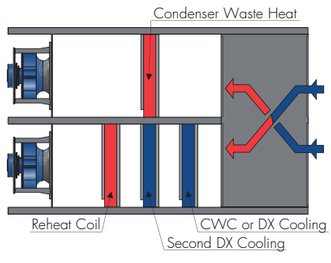
The PCU-E-D uses a DX evaporator to cool the air to its specified dewpoint, then uses a precise three-way modulating valve to direct sufficient condenser heat to reheat the air to it's set point temperature with the remainder exhausted to the spill air.

PCU-E-H Hybrid Cooling



The PCU-E-H uses a DX evaporator to take only enough heat from the air that is needed for reheat. The air is then cooled to its specified dew point with a CHW coil before being reheated. As the DX evaporator only takes the heat it needs for reheat, there is no waste heat generated.

PCU-E-LD Low Dew Point



The PCU-E-LD uses two cooling coils, the first being either a CHW coil or a DX evaporator, the second is a DX evaporator to lower the air to its specified dewpoint. A precise three-way modulating valve directs sufficient condenser heat to reheat the air to a set point temperature with the remainder exhausted to the spill air.

Technical Data

PCU-E-D							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		100% unless Return Air Bypass Mode is incorporated					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	Reverse cycle available upon request					
Supply Air Moisture Content		>8g/kg dry air					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Dimensions		Contact your Air Change representative					

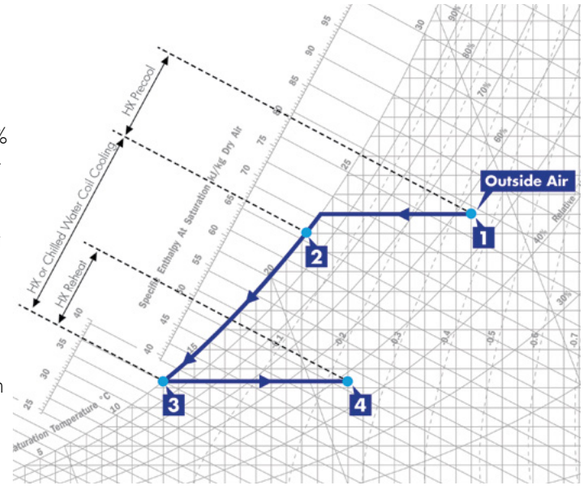
PCU-E-H							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		100% unless Return Air Bypass Mode is incorporated					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	N/A					
Supply Air Moisture Content		CHW temperature dependent					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Dimensions		Contact your Air Change representative					

PCU-E-LD							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		100% unless Return Air Bypass Mode is incorporated					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	Reverse cycle available upon request					
Supply Air Moisture Content		>5g/kg dry air					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Dimensions		Contact your Air Change representative					

*Specifications are subject to change. Refer to project certified documents for finalised details.

PCU-S

The Air Change PCU-S dehumidification system is suited to applications that have no spill air but have sufficient plant room area to incorporate a sensible heat exchanger in the unit to pre-cool and reheat the air. Whilst not as efficient as the PCU-E, the PCU-S still reduces the refrigeration energy by between 20 to 30% depending on the outside air condition and the specified set point temperature.



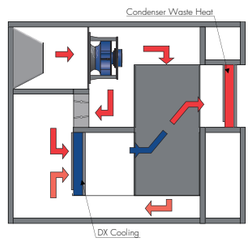
Again, the PCU-S is usually configured in a DOAS application but can be used in any air recirculation system.

The PCU-S can also be ordered in three different configurations:

1. a **full DX** cooling system for applications with no chiller;
2. a **hybrid** version (part DX and part chilled water cooling) when chilled water is available and DX cooling is only required to supply reheat; and
3. a **low dew point** version for low moisture content applications. The LD system is supplied as either a DX or hybrid cooling system.

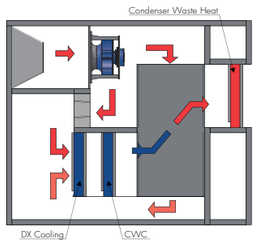
In hot, tropical zones, where the lowest outside air temperature is sufficient to raise the supply air temperature to its set-point condition, there is no need for a reheat coil and the Air Change ACDHUM is the perfect solution.

PCU-S-D DX Cooling



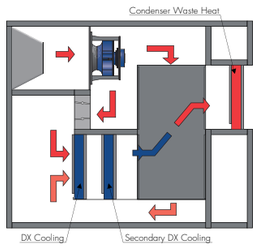
The PCU-S-D uses a DX evaporator to cool the air to its specified dewpoint after passing through the HX, then uses a precise three-way modulating valve to direct sufficient condenser heat to a reheat condenser to raise the air to its set point temperature with the remainder directed to an external condenser.

PCU-S-H Hybrid Cooling



The PCU-S-H uses a DX evaporator to take only enough heat from the air that is needed for reheat. The air is then cooled to its specified dew point with a CHW coil before being reheated with the reheat condenser coil. As the DX evaporator only takes the heat it needs for reheat, there is no waste heat generated and therefore no outside condenser required.

PCU-S-LD Low Dew Point



The PCU-S-LD uses two cooling coils, the first being either a CHW coil or a DX evaporator, the second is a DX evaporator to lower the air to its specified dewpoint. A precise three-way modulating valve directs sufficient condenser heat to reheat the air to its set point temperature with the remainder either directed to an external condenser or removed through the chilled water circuit.

Technical Data

PCU-S-D							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		100%					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	Reverse cycle available upon request					
Supply Air Moisture Content		>8g/kg dry air					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Dimensions		Contact your Air Change representative					

PCU-S-H							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		100%					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	N/A					
Supply Air Moisture Content		CHW temperature dependent					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Dimensions		Contact your Air Change representative					

PCU-S-LD							
Model Number:		**5**	**10**	**15**	**20**	**30**	**40**
Supply Air (l/s)		500	1000	1500	2000	3000	4000
Outside Air		100%					
Capacity (kW)	**Cooling**	Sized to project requirements					
	Heating	Reverse cycle available upon request					
Supply Air Moisture Content		>5g/kg dry air					
Compressor Type		BLDC Inverter					
Refrigerant		R410A					
Fan Type		3 Phase EC Plug Fans - Variable Speed					
Volts / Ph / Hz		415 / 3 / 50					
Construction		50mm Polyurethane Sandwich Panel					
Dimensions		Contact your Air Change representative					

*Specifications are subject to change. Refer to project certified documents for finalised details.

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AIR CHANGE
DOAS & DEHUMIDIFICATION

For more than 20 years, Air Change has provided unique equipment and engineering solutions for local and international clients using our internationally patented heat and energy recovery technology. During that time, we have developed a comprehensive range of energy efficient products to deliver controlled indoor climate conditions satisfying the requirements of all project stakeholders: the developer, the design engineer, and the building's owner and occupants.

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